

CAAP Quarterly Report

Date of Report: *Dec. 31th, 2018*

Contract Number: *693JK31850009CAAP*

Prepared for: *U.S. DOT Pipeline and Hazardous Materials Safety Administration*

Project Title: *New Bio-Inspired 3D Printing Functionalized Lattice Composites for Actively Preventing and Mitigating Internal Corrosion*

Prepared by: *North Dakota State University*

Contact Information: *Mr. Muhammad Naveed Metla, PhD student, Email: muhammadnaveed.metla@ndsu.edu@ndsu.edu, Phone: 701-231-7204; Mr. Matthew Pearson, M.S. student, Email: matthew.pearson@ndsu.edu, Phone: 701-231-7204; Dr. Zhibin Lin, Email: zhibin.lin@ndsu.edu, Phone: 717-231-7204; Dr. Bashir Khoda, Email: bashir.khoda@ndsu.edu, Phone: 701-231-7195*

For quarterly period ending: *Dec. 31, 2018*

Business and Activity Section

(a) Generated Commitments

No changes to the existing agreement

Purchase made for the nano-materials, and the 3-D printable polymer over this reporting period

Kick-off teleconference meeting was held on Dec. 3rd, 2018.

(b) Status Update of Past Quarter Activities

The research activities in the first quarter consist of the kick-off meeting, the literature review, and some preliminary work prepared for Task 2, as summarized below.

Task 1: Literature review and kick off meeting

Kick-off meeting

The first kick-off teleconference meeting with the USDOT personnel, Mr. Buddy Secor, was held on Dec. 3rd, 2018. The meeting agenda and major activities in the kick-off meeting were shown in Table 1. The understandings from this task are expected to lead to our proposed concept and a systematic study will be then addressed in later tasks.

Table 1 Kick-off teleconference meeting agenda (Monday, Dec. 3rd, 2018)

Items	Major Contents	Note
Objectives	<ul style="list-style-type: none">a. Introduction of the framework and the role of the PHMSAb. Introduction of the project background and the expected outcomesc. Discussion of detailed contents in the proposed workd. Future plan	Attendees: Buddy Secor (USDOT PHMSA), Bashir Khoda (NDSU), Zhibin Lin (NDSU), Muhammad Metla (NDSU).
Detailed Activities	<ul style="list-style-type: none">a. Introduction<ul style="list-style-type: none">○ Mr. Secor gave basic information of his role as a project director○ The PIs introduced themselvesb. Project Information and Discussion<ul style="list-style-type: none">○ Dr. Lin introduced the background of this project, motivation of the concepts, and the expected outcomes○ Drs. Lin and Khoda addressed the potential research challenges in the efficiency of the new developed composites and the durability of the 3-D printing materials in severe environmentsc. Pipeline Safety and Public Awareness<ul style="list-style-type: none">○ Mr. Secor and the PIs all agree with the fact of improving the public awareness of the pipeline safetyd. Student Training and Involvement *e. Future Plan<ul style="list-style-type: none">○ Mr. Secor had a travel plan in near future to NDSU.f. Other items **	<p>* The PIs expressed their appreciation for the effort in this PHMSA program on high expectation of student involvement.</p> <p>** this included the format of the reports, and practical guidance for dissemination of the findings</p>

Literature Review

Pipeline spill or explosion accidents occurred in recent years, as shown in Fig. 1, while corrosion is one of the leading causes of failures of these metallic pipelines in the United States. Much research on the fundamentals of corrosion on pipelines has been extensively studied and the mechanisms are well understood.

Early-age detection of corrosion or corrosion-induced damage for the onshore gas and liquid transmission pipelines are extremely critical for public safety. The state-of-the-art practices and technologies were summarized in pipeline industry. The methods in the literature could be basically categorized as destructive and non-destructive inspection/detection ones.

The existing nondestructive testing (NDT) methods, such as ultrasonic testing (UT), radiographic testing (RT) or magnetic particle inspection (MT), are usually used for pipeline quality inspection at specific spots.

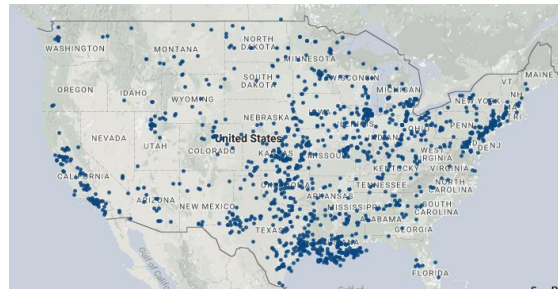


Fig. 1 Pipeline accidents in the United State (Photos from <http://projects.propublica.org/pipelines/>)

Alternatively, other available types of the NDT methods provide great potential for pipeline-like long-distance assessment and management. Smart pigs, or in-line inspection (ILI) pigs, are the most sophisticated technology used in current pipeline monitoring market. Mitigation techniques refer to the methods or techniques used for preventing/mitigating/remediating corrosion of a pipe system.

To sum up, existing inspection/mitigation technologies either may not enable identifying/locating early-age occurrence of corrosion or cannot actively mitigate them even if any. Thus, it is time to reconsider the current dominant strategies.

(c) Description of any Problems/Challenges

No problems are experienced during this report period

(d) Planned Activities for the Next Quarter

The planned activities for next quarter are listed below:

- First direction will select and characterize the 3-D printable polymer and,
- Another direction will synthesize and characterize the composite.